

## **REMARKS**

Claims 1, 3, 4, 6-11, and 21-23 are currently pending and under examination.

In the Office Action,<sup>1</sup> the Examiner:

- a) rejected claims 1, 4, 6, and 7 under 35 U.S.C. § 102(b) as being anticipated by Nakajima et al. (U.S. Patent No. 5,907,188, "Nakajima"); and
- b) rejected claims 3, 8-11, and 21-23 under 35 U.S.C. § 103(a) as being unpatentable over Nakajima in view of Hu (U.S. Patent No. 5,962,904, "Hu").

By this amendment, Applicants have amended claims 1 and 8 to more appropriately define the invention.

Applicants traverse the rejection of claims 1, 4, 6, and 7 under 35 U.S.C. § 102(b) as being anticipated by Nakajima. In order to properly establish anticipation under 35 U.S.C. § 102, the Federal Circuit has held that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1126, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). See also M.P.E.P. § 2131.

Nakajima does not anticipate Applicant's independent claim 1 for at least the reason that Nakajima fails to disclose the claimed "forming a second insulating film

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<sup>1</sup> The Office Action may contain statements characterizing the related art, case law, and claims. Regardless of whether any such statements are specifically identified herein, Applicants decline to automatically subscribe to any statements in the Office Action.

comprising a metal oxide film or a metal silicate film by oxidizing said metal compound film,” as recited in claim 1.

The Examiner alleges that “Nakajima describes ... forming a second insulating film metal-containing insulating film consisting of a metal oxide film or a metal silicate film by oxidizing said metal compound film (figs. 2,9 and 16 embodiment wherein WN is oxidized to form layer 4).” Office Action at page 3. The Examiner further alleges, in the Response to Arguments section, that “Applicants’are not considering Nakajima’s embodiment wherein a WN layer is present shown at least in figs. 2,9 and 16 and described in the specification ( some portions reproduced below).” Office Action at pages 7-8.

Applicants have considered the portions of Nakajima cited by the Examiner and “Nakajima’s embodiment wherein a WN layer is present shown at least in figs. 2,9 and 16” and submit that Nakajima fails to disclose the claimed “forming a second insulating film comprising a metal oxide film or a metal silicate film by oxidizing said metal compound film,” as recited in claim 1, as discussed below.

Fig. 2 of Nakajima, for example, measures two sets of oxide thicknesses: the first set, shown by white dots, captioned “WITH WN<sub>x</sub> (PRESENT INVENTION),” and the second set, shown by black dots, captioned “WITHOUT WN<sub>x</sub> (PRIOR ART).” As described in Nakajima’s specification:

“as shown in FIG. 1B, the **silicon substrate 1 is subjected to the oxidation process** ... to form an oxide film 4 on the interface between the silicon substrate 1 and the tungsten nitride film 2. ... The film thicknesses (oxide

thicknesses) of the oxide film 4 of the thus obtained sample ... were measured ...

The result of the measurements (white dots in FIG. 2) is shown in FIG. 2. As a comparison example, the result of the measurements (black dots in FIG. 2) of the film thickness of an oxide film obtained by **oxidizing a silicon substrate 1** having no  $W/WN_x$  film ... is also shown.” Nakajima, col. 9, lines 38-58.

Emphases added.

As discussed in Nakajima, the two measurements compare the thickness of silicon oxide in the presence of  $WN_x$ , and the thickness of silicon oxide in the absence of  $WN_x$ . As noted above, in both measurements, the measured oxide film 4 is formed from the **silicon substrate 1**, not from the tungsten nitride film 2.

Similarly, Fig. 9 of Nakajima shows film thicknesses of **two silicon oxide films**: a silicon oxide film 31 (as shown in Fig. 8 of Nakajima) formed from subjecting a sample, including a  $WSiN$  film 32 and a  $W$  film 33, and an oxide film 31 formed from a sample having no  $WSiN$  film 32. See Nakajima, col. 15, lines 25-44. Again, the silicon oxide films 31 in both measurements are formed by oxidizing the silicon substrates 30.

The measurements shown in Figs. 2 and 9 thus represent an oxide films obtained by oxidizing a silicon substrate, regardless of whether the tungsten nitride film 2 or the  $WSiN$  film 32 is present. In fact, there is **no disclosure** in Nakajima’s Fig. 2, 9, or 16, or any other portion of Nakajima regarding any “embodiment wherein the **tungsten nitride film 2 is oxidized to form layer 4**,” as alleged by the Examiner.

In addition, claim 1 of the present application recites, “forming a first insulating film, selected from a silicon oxide film, a silicon nitride film, and a silicon oxynitride film, on a semiconductor substrate; forming a metal compound film on the first insulating

film." That is, in claim 1, after forming a first insulating film, selected from a silicon oxide film, a silicon nitride film, and a silicon oxynitride film, on a semiconductor substrate, a metal compound film is formed on the first insulating film.

On the other hand, Nakajima does not include the above step. That is, in Nakajima, after a metal compound film (WN film 2) is formed in the step shown in FIG. 1A, a first insulating film (oxide film 4) is formed in the step shown in FIG. 1B. Thus, it is clear that Nakajima does not include the above step recited in the present invention.

Further, claim 1 of the present application recites, "metal compound film does not contain tungsten." On the other hand, in Nakajima, the metal compound film (WN film 2) contains tungsten (W). Therefore, it is clear that the present invention differs from Nakajima in this point.

For at least these reasons, Nakajima cannot disclose each and every element recited in claim 1. Since Nakajima does not disclose each and every element of claim 1, Nakajima cannot anticipate Applicants' claim 1 under 35 U.S.C. § 102(b). Accordingly, claim 1 is allowable over Nakajima at least for this reason, and claims 4, 6, and 7 are also allowable at least due to their dependence from claim 1. Thus, the 35 U.S.C. § 102(b) rejection of claims 1, 4, 6, and 7 should be withdrawn.

Applicants traverse the rejection of claims 3, 8-11, and 21-23 under 35 U.S.C. § 103(a) as being unpatentable over Nakajima in view of Hu. A *prima facie* case of obviousness has not been established.

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See M.P.E.P. § 2142, 8th Ed., Rev. 5 (August 2006). Moreover, "in formulating a rejection

under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed. " USPTO Memorandum from Margaret A. Focarino, Deputy Commissioner for Patent Operations, May 3, 2007, page 2.

Regarding claim 3, claim 3 depends from claim 1, and thus requires each and every element recited in claim 1. A *prima facie* case of obviousness has not been established because, among other things, Nakajima and Hu, taken alone or in combination, fail to teach or suggest each and every element recited in claim 1 and required by dependent claim 3.

As discussed above in regard to the Examiner's § 102(b) rejection of claim 1, Nakajima fails to teach or suggest the claimed "forming a second insulating film comprising a metal oxide film or a metal silicate film by oxidizing said metal compound film." The Examiner relies on Hu for teaching a metal compound film having a thickness not larger than 5 nm. See Office Action at page 5. However, even if Hu provides such teachings, Hu is silent as to any teachings of a second insulating film by oxidizing a metal compound film, and thus fails to overcome the shortcomings of Nakajima discussed above in regard to claim 1. That is, Hu also fails to teach or suggest "forming a second insulating film comprising a metal oxide film or a metal silicate film by oxidizing said metal compound film," as recited in claim 1, and required by claim 3.

Accordingly, no *prima facie* case of obviousness has been established regarding claim 3. Claim 3 is thus allowable over the Examiner's proposed combination of Nakajima and Hu, at least due to its dependence from allowable claim 1.

Regarding independent claim 8, Nakajima and Hu, taken alone or in combination, fail to teach or suggest at least the claimed “forming a metal-containing insulating film comprising a metal oxide film or a metal silicate film by oxidizing said metal compound film,” as recited in claim 8. The Examiner again alleges that layer 4 of Nakajima constitutes such metal-containing insulating film. See Office Action at page 6. However, Applicants have already shown above that Nakajima’s silicon oxide film 4 is not formed by oxidizing a metal compound film, but rather formed by oxidizing a silicon substrate. Moreover, Hu also fails to teach or suggest forming of a metal-containing insulating film by oxidizing a metal compound film.

Additionally, the combination of Nakajima and Hu also fails to teach or suggest that “each of said first insulating regions is **formed in** said second insulating region,” as recited in claim 8 (emphasis added). The Examiner states that “a second insulating region formed of an amorphous insulating material in a region (Hu layer 14-crystalline) and except the first insulating regions. (Hu layer 18 amorphous).” Office Action at page 6. Thus, it appears that the Examiner contends that layer 14 of Hu corresponds to the claimed “first insulating region,” and layer 18 of Hu corresponds to the claimed “second insulating region.”

Fig. 1 of Hu teaches a structure including a gate oxide layer 14 and a diffusion barrier 18. Hu describes that the diffusion barrier 18, comprised of a refractory metal silicon nitride, is amorphous. See Hu, col. 5, lines 7-9. However, as clearly seen in Fig. 1, the gate oxide layer 14 is **not formed in** the diffusion barrier 18. On the contrary, since the gate oxide layer 14 and the diffusion barrier 18 are separated by a layer of silicon-containing material 16, the gate oxide layer 14 **cannot** be formed in the diffusion

barrier 18. Therefore, even if the Examiner's characterization could be considered correct, Hu fails to teach or suggest the claimed "each of said first insulating regions [being] formed in said second insulating region," as recited in claim 8.

Further, claim 8 recites, "metal compound film does not contain tungsten." However, in Nakajima, the metal compound film (WN film 2) contains tungsten (W). Thus, it is clear that the present invention differs from Nakajima in this point.

For at least the reasons discussed above, no *prima facie* case of obviousness has been established. Claim 8 is therefore allowable over the Examiner's proposed combination of Nakajima and Hu, and claims 9-11 and 21-23 are allowable due to their dependence from claim 8. Thus, the 35 U.S.C. § 103(a) rejection of claims 3, 8-11, and 21-23 should be withdrawn.

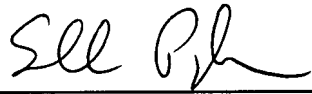
In view of the foregoing, Applicants request reconsideration of the application and withdrawal of the rejections. Pending claims 1, 3, 4, 6-11, and 21-23 are in condition for allowance, and Applicants request a favorable action.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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